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Request for grant of a patent

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1. Your reference — CDK1548

2. Patent application number *(The Patent Office will fill in this part)* — **9913034.6**

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

ALBRIGHT & WILSON UK LIMITED,
210-222 HAGLEY ROAD WEST,
OLDBURY, WARLEY,
WEST MIDLANDS,
B68 0NN.

Patents ADP number *(if you know it)* 68042640002

If the applicant is a corporate body, give the country/state of its incorporation — ENGLAND

4. Title of the invention — POLYMERISABLE SURFACTANTS

5. Name of your agent *(if you have one)* — Barker Brettell

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

138 Hagley Road
Edgbaston
Birmingham
B16 9PW

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Country	Priority application number *(if you know it)*	Date of Filing *(day/month/year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day/month/year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request *(Answer 'Yes' if:*
a) any applicant named in part 3 is not an inventor, or
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11. I/We request the grant of a patent on the basis of this application.

Signature: Barker Brettell
Barker Brettell

Date: 04 June 1999

12. Name and daytime telephone number of person to contact in the United Kingdom: Mr C D Kinton — Tel: 0121 456 1364

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POLYMERISABLE SURFACTANTS

The present invention relates to polymerisable surfactants comprising at least one hydrophobic polymerisable group which is linked by polyalkyleneoxy groups to a hydrophilic group. The surfactants are particularly useful in emulsion-polymerised surface coatings. The present invention also relates to a method of making the polymerisable surfactants, to uses thereof, and to surface coatings including the surfactants.

Polymerisable surfactants are known in the art and have often been used in surface coatings. However, such prior-art surfactant-containing coatings have a tendency to absorb moisture resulting in partial detachment of the coating, a problem known as "bloom". The problem of "blush", a whitening effect of a coating when subjected to prolonged immersion in water, is also evident in coatings containing prior-art surfactants.

The object of the present invention is to provide a polymerisable surfactant which is particularly suitable for use in surface coatings, which has improved water resistance and which reduces the problems of "bloom" and "blush" in coatings. A method of making such a polymerisable surfactant is also provided.

According to a first aspect, the present invention provides a polymerisable surfactant having at least one hydrophobic polymerisable group which is linked by polyalkyleneoxy groups to a hydrophilic group, wherein the polymerisable surfactant is of the general formula:

$(RCH = CR'COO\ [CH_2CHR''O]_x)_n\ PO\ (OY)_m$

where $n+m = 3$

x is between 5 and 40

R = H or CH_3 or COOR'''

R' = H or CH_3

R'' = H, CH_3 or C_2H_5

R''' = C_1 - C_{20} alkyl

Y = H or an alkali metal atom

Preferably the hydrophobic polymerisable group represented by RCH = CR'COO is acrylate or methacrylate, in which case R is hydrogen and R' is hydrogen or methyl respectively.

The hydrophobic polymerisable group may alternatively be maleate, fumarate, crotonate or isocrotonate.

Preferably x is between 10 and 30, more preferably 17 and 22, most preferably x is 20.

Preferably the oxyalkylene groups represented by $[CH_2CHR''O]$ comprise mainly propyleneoxy groups. For example, from 80% - 100% of the oxyalkylene groups may be propyleneoxy groups. Preferably, at least 90%, more preferably at least 95% and most preferably at least 98% of the oxyalkylene groups are propyleneoxy groups.

The balance of the oxyalkylene groups not being propyleneoxy groups is preferably selected from ethyleneoxy or butyleneoxy groups.

The oxyalkylene groups as well as acting as linking groups, in fact form the main hydrophobe in the polymerisable surfactant.

Preferably the hydrophilic group represented by $PO(OY)_m$ is a phosphate group, i.e. Y represents hydrogen. Alternatively, the hydrophilic group may be a water-soluble phosphate salt group, for example alkali metal phosphate, in which Y represents an alkali metal atom.

Although it is not intended that the present invention be construed with reference to any particular theory, it is believed that surfactants according to the present invention exhibit improved water-resistance in comparison with prior-art surfactants because they do not include a non-ionic hydrophilic group, such as polyethylene oxide. In many prior-art polymerisable surfactants, a hydrophilic non-ionic group is present which can give rise to poor water sensitivity in a final coating. Ionic groups are only hydrophilic when ionised and therefore the resultant dried coatings are less hydrophilic and less water sensitive than coatings including non-ionic hydrophiles.

According to a second aspect, the present invention provides a method of making a polymerisable surfactant according to the first aspect of the present invention, the method comprising the steps of:

reacting an unsaturated carboxylic acid corresponding to the hydrophobic group with an alkylene oxide corresponding to the oxyalkylene linking group while maintaining the temperature of the reaction below that at which spontaneous polymerisation of the unsaturated groups of the hydrophobic group would occur; and

phosphating the resultant polyalkoxylated hydrophobic group.

The polyalkoxylation process step may be carried out with the aid of a catalyst. The catalyst is preferably a catalyst for alkoxylation which does

not catalyse the polymerisation of unsaturated groups of the hydrophobic group.

A preferred catalyst for alkoxylation is a strong Lewis acid such as boron trifluoride.

Preferably, a portion, most preferably a small portion, of the catalyst for alkoxylation is added to the unsaturated carboxylic acid before the alkylene oxide. Preferably the bulk of the catalyst is added with the alkylene oxide. A remaining portion of the catalyst is preferably added after completion of addition of the alkylene oxide to maximise conversion as the catalyst has a short active life. Hydroquinone is preferably added to the reaction mixture after the addition of the remaining portion of the catalyst. The hydroquinone is added to inhibit autopolymerisation of the unsaturated groups of the hydrophobic group. Any unreacted alkylene oxide may be removed, preferably by sparging with air.

Preferably, the reaction of the unsaturated carboxylic acid and the alkylene oxide is carried out in an inert atmosphere, for example under nitrogen. The reaction mixture may be stirred. Preferably, moisture is excluded from the reaction mixture. Preferably, the alkylene oxide is added continuously at a constant rate over a given time period, suitably 90 minutes.

The phosphation step is preferably carried out by means of phosphorus pentoxide. The most preferred form of phosphorus pentoxide is the solid form. The phosphorus pentoxide may be added over a given period of time, preferably one hour. Preferably, when addition of the phosphorus pentoxide is complete, the resulting mixture is maintained at an elevated temperature, such as 80°C, for about 4 hours, with stirring.